and "R–" the reverse control wire, and "G–" the accidental ground on the normal control wire. "I. B." is the indication bus bar, or wire.

With the lever in the position shown, that is, normal, it can readily be seen or traced out, that the positive side of the battery will be grounded. This can then be proved by grounding the negative side of the battery at the ground detector by throwing the switch to the left, which will then light the ground lamp.

The switch lever is now thrown to the reverse position, thereby disconnecting the grounded normal control wire from the battery, but it is at once connected to the common wire through the indication magnet, the polarized relays, and the indication bus bar, or wire.

By observing the sketch (Fig. 1) it can readily be seen again that now the negative side of the battery is connected to ground, through the polarized relays, indication bus and magnet. If now the ground detector switch is thrown to the right, it will connect the positive side of the battery to ground through the ground lamp, which will light up, a complete circuit having again been established.

After the switch machine has operated the pole-changer "C-" is reversed. This disconnects the reverse control wire from the

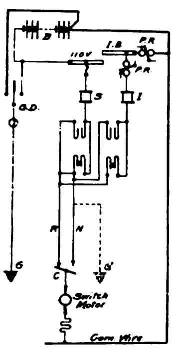

Fig. 1.

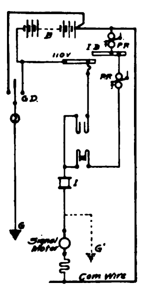

Fig. 2.

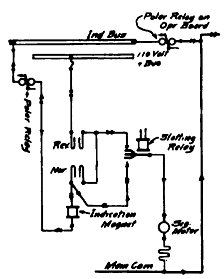

Fig. 3.

motor and connects the normal control wire to it, which places the switch motor in parallel with the indication magnet, polarized relays and indication bus, between the negative side of the battery and the accidental ground on the control wire.

In the second case mentioned above, the trouble may be caused by a grounded signal control wire. When the signal lever is first pulled to the reverse position it will show a slight ground on the ground detector, due to the fact that the motor circuit is of low resistance—lower than the resistance of the ground.

After the signal has attained the clear position and the high resistance retaining mechanism coils are cut into the circuit, it would show a heavier ground on the ground lamp, as then the grounded circuit would be more evenly balanced with the signal circuit, the two being in parallel.

When the signal lever is again put normal the grounded control wire is connected to the negative side of the battery through the indication magnet and bus bar and the polarized relays, and if the ground detector switch is held to the right it will show a negative ground. A signal circuit is shown in Fig. 2, the letters in this sketch representing the same parts as those in Fig. 1.

Many repairmen and helpers do not fully understand the connections of the ground-detector on the operating board. This is undoubtedly due to the fact that the average wiring plan of the operating board is a rather formidable appearing mass of lines, and on this account the circuits shown in Figs. 1 and 2 have been drawn as simply as practicable, while still showing all the essential parts and wires.

STORAGE BATTERIES DURING COLD WEATHER.

The claim is often made that storage batteries are not materially affected by cold weather; that while their efficiency is decreased their operation is not seriously or materially impaired. That such supposition or claim is erroneous was proved by the severe weather last winter on the C. & N. W. Terminal.

A number of combination storage battery and generator houses are located on the track elevation above street level. These houses are exposed to the elements from all sides. The batteries in them are used for automatic signal and track circuit operation.

During the early part of last winter (1911) it was observed that the automatic signals at one of the locations operated very slowly. An inspection was made at once and it was found that there was a very slight scum of ice on the surface of the electrolyte of the storage cells, the gravity of which was then quite high. No water had been added for some time and they had been fully charged 48 hours previously. The batteries are charged once each week, although they will carry the load at least two weeks without charging. While this inspection was being made, a signal at the location cleared so slowly that it failed to cut out the motor circuit. The motor generator set was started at once so as to stir up and warm up the electrolyte. The same thing was done at once at all the signal bridges where these houses are located. All batteries at the different locations are in duplicate, and the charge was changed into the other sets during the night.

It was then imperative to install some sort of heating device at once. Oil lamps were out of the question, not only on account of lack of space, but also on account of the danger of fire. It was decided to install electric lights for heaters, as the current for them was available, the 220-volt A. C. three-phase line being in the generator compartment of each combination house. The batteries are on three shelves, and two lamp sockets in series were suspended above each shelf, making six lamps in series-multiple in each house. Sixteen c. p. carbon filament 110-volt lamps were used, and the heat from them was sufficient during the very severe weather of last winter (1911-1912) to prevent any further trouble. The wiring at that time was of a temporary nature, but it has since been made permanent.

SPEED RESTRICTIONS ON THE CHICAGO & NORTH WESTERN.

The Chicago & North Western recently made practical tests of its speed restrictions of the movements of trains over crossovers, turnouts, junction turnouts, and on certain signal indications at interlocking plants, and as a result has established additional safeguards and rules to govern the speeds of trains. These are as follows:

(1)—When a signal to proceed is displayed by a dwarf or low-speed signal located at the bottom of a home signal, or across the track from it, a train may proceed at a speed not to exceed 15 miles per hour.

(2)—The speed of a train moving over a crossover, a turnout from a main track to a siding, or to a diverging route at a junction, must not exceed 15 miles per hour, except as follows:

the points at which exceptions are permitted being indicated on the current timetable by special rules, which give in each case the speed in miles per hour that may be attained at any particular point or turnout at which the above-mentioned rules do not apply.

In formulating the rules for the restriction of the speed of trains at definite points, or for turnouts of varying degrees, the question arose in each case as to whether the restrictions were sufficient to insure absolute safety and smooth operation for the train, or whether they were greater than necessary. That is to say, did the restrictions call for lower speed than was essential for the safe and smooth operation over the certain stretches of track? In order to satisfy themselves on this point the general officers of the road conducted a series of speed tests over the crossovers and turnouts in question. A train composed of a high-speed locomotive and several cars was employed for this purpose. A speed indicator was installed in the locomotive for the government of the engineman, and another one in the observation car on the rear of the train for the convenience of the observers, who were general officials and officials of the division on which the tests were being made. Telephone communication was also established between the locomotive and the observation car, a complete telephone outfit being located in the observation car.

Speed tests were made over leads and crossovers, over turnouts from No. 7 to No. 20, and at different speeds over each number of turnout, these varying from five miles per hour over No. 7 turnouts to over 50 miles per hour over No. 20 turnouts. The train was run through each turnout several times at different speeds, and always once or twice at a higher rate of speed than was considered at all, or was later decided upon for that number of turnout.

Careful records were made of the different speeds over each turnout and the behavior of the train noted in each case. It was found throughout the test that it is very difficult to judge the speed of a train while riding on it. Every one in the large party on the train was inclined to believe that its speed when moving at 20 miles or less per hour was less than was actually the case. And when going at 35 miles or more per hour it seemed that the train was running at a higher than its actual rate of speed.

The speeds of trains under these restrictions are checked frequently to find out how closely enginemen are able to judge them, and, as an additional precaution, a more general use of speed recorders which will accurately indicate to the engineman the speed at which he is running will be adopted in the near future.

THE SONG OF THE SEMAPHORE-

The following poem was published in the "Washington (D. C.) Herald" of Sunday, February 16, 1913. It is entitled "Block Signals," and was written by Alice Lovett Carson:

Guarding the trains that pass our door,
Over the track stands the semaphore;
Great long arms that move in air
Tell of safety or danger there:
    Outward pointing: "A train's gone by."
    Downward slanting: "No danger nigh."
Trainmen, scanning the distance o'er,
    Glancing on high,
    Note, as they fly,
The signaling, silent semaphore.

Out in the dark, when day's asleep,
The semaphore lanterns twinkle and peep;
Each great arm has a blinking eye
To wink at the trains as they rumble by:
    Red: "Take care, there is danger near!"
    Green: "Go ahead, for the track is clear."
Trainmen know of this color lore,
    Glancing on high
    At the warning eye
Of the winkety, blinkety semaphore.

Faithful watcher above the rail,
Lost were the trains should your signals fail;
Passengers slumber in safety so,
Knowing the signals tell how to go:
    Straight or slanting, green light or red,
    Speaking truly of what's ahead.
Trainmen, fearful of fate in store,
    Glancing on high,
    Thankfully spy
The cheering, guardian semaphore.

THE SOO LINE has posted a notice in its shops at Fond du Lac, Wis., forbidding the wearing of neckties or torn overalls by its workmen. Shop records show that in the past both the ties and the tatters have resulted in many accidents.

ASPECTS FOR INTERMITTENT CONTACT SIGNALS.

BY CARL P. NACHOD.

Standardization of signal aspects is of such essential importance that attention need hardly be called to it. Track circuit signaling, especially on steam roads, has been consistently developed, committees and associations having worked together so as to obtain a series of recommended aspects which are being adopted as fast as practical.

The matter of aspects for intermittent contact signaling, however, has been left pretty much to itself, the several manufacturers having developed these types along lines that seemed best to them, which has resulted in a needless diversity of indications.

It is hoped that those having authority, and desirous of harmonizing aspects of track circuit and intermittent contact signaling, will thoroughly familiarize themselves with the fundamental principles of the latter, in order to save time.

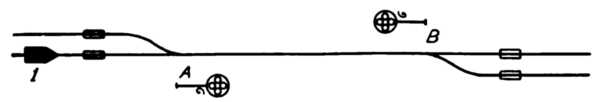

Fig.1

Signal A: Neutral position; pass contactor, block clear, opposing signal neutral. Signal B: Neutral.

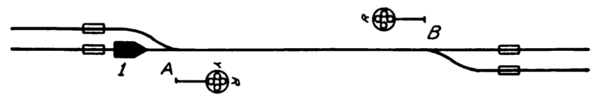

Fig 2.

Signal A: Change from neutral to permissive "a" position; proceed through block, opposing signal at stop. Signal B: Stop.

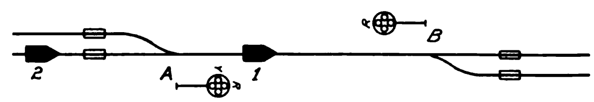

Fig 3

Signal A: Permissive "a" position; pass contactor under control, block occupied by train in same direction. Signal B: Stop.

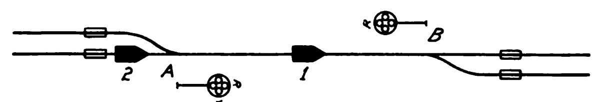

Fig.4

Signal A: Change from permissive "a" to permissive "b" position; proceed through block under control, train has registered, opposing signal will remain at stop so long as train 2 remains in block. Signal B: Stop.

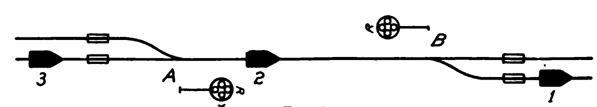

Fig.5.

Signal A: Permissive "b" position; pass contactor under control, block occupied by train in same direction. Signal B: Stop.

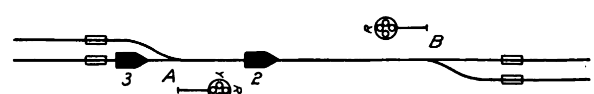

Fig.6.

Signal A: Change from permissive "b" to permissive "a" position; proceed through block under control, train has registered, opposing signal will remain at stop so long as train 3 remains in block. Signal B: Stop.

As light signals have been successful for day, under conditions of constant voltage supply, it is proposed to use them for trolley contact signaling where the lighting is usually done from the trolley current for reasons of economy. It is also proposed to use lights alone, or semaphores with lights for the night indication, the disk signal not being recognized.

In the first place light signals supplied by the trolley current were naturally used on the earliest trolley contact systems for electric railways, but were later rejected in consequence of the great voltage variation on such systems. It is the opinion of the writer that lights do not constitute an adequate day signal for electric railways unless they are supplied from a separate constant potential transmission system. For, because of the variation of line voltage on the majority of interurban roads, the candle power of the signal lamps when they are fed from the trolley circuit is reduced to so low a value with only a small voltage reduction as to make the light valueless for day. Experience has shown that hooded lamps of *considerable* candle power burning at *normal* brilliance form a sufficient day indication; which is in striking contrast with the two-candle power oil light familiar to signal engineers. To obtain this, however, on the trolley circuit means a separate set of lighting mains—a great increase in expense. Therefore a disk signal having a

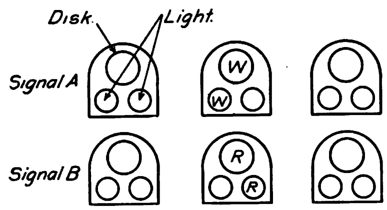

Fig. 7. System with Three Lights and "Blink" Green Neutral.

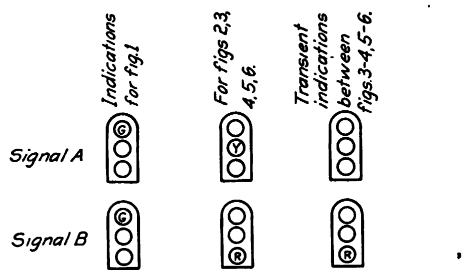

Fig. 8. System with Two Lights and Disks, Blink; No Light, No Disk Neutral. Marker Light Required.

disk of the same color as the light, and always displayed therewith, makes a very satisfactory day indication, the lights and disks constituting under normal voltage a single field of color approximately twice the size of either indication. At times of low voltage when the lamp is dim, and the uncertainty produced by this dimness aggravated by more or less direct sunshine, this very sunshine is converted into a positive benefit in the case of the disk signal, which then becomes of great brilliance.

Signal engineers experienced on steam roads have assumed that since the disk signal on their roads has been largely replaced by the semaphore, it is not useful on electric railways.

The full advantage of the semaphore over the color disk is not realized on electric railways in actual practice, where often a sky background may not be had and it is hard to keep the semaphore distinguished from the maze of poles and crossarms of the trolley line. Recourse is had to painting it brilliantly with a color, and leaving a stripe on the blade for contrast, the effect being that the semaphore is picked out from the rest of the landscape by color contrast.

The writer has already mentioned certain requirements in aspects for contract signaling,* and this paper is devoted to a further exposition of several possible systems.

Figs. 1 to 6 show a system using four lights and having an alternating permissive signal. Under each figure there is given in order:

a—Position of signal;
b—Running rule;
c—Explanation.

Comparing Figs. 3 and 4, it will be noted that with train No. 1 in the block the permissive indication is red with yellow staggered to the left. As soon as train No. 2 passes under the contactor, this changes the signal to the other permissive indication, red staggered with yellow to the right, and successive following cars alternate these indications.

Fig. 7 shows the corresponding indications for Figs. 1 to 6, using a simple system of three lights vertically disposed, and a "blink" or temporary extinction of the yellow light as an indication for following cars. The objection to this is that the motorman must have his eyes on the signal at the time of passing the contactor.

Fig. 8 shows a system of the utmost conceivable simplicity using only two lights and a blink for following cars, the neutral signal being no light. The aspects show a disk of the same color as the light, and simultaneously exhibited, so as to obtain the advantages of the disk signal above referred to. Red and white have been preferred over red and yellow, since their contrast is better; and over red and green, since the green would have to indicate block occupied. A marker light should burn with this system at all times to locate the signal at night.

*Signal Aspects for Single Track Electric Railways, *The Signal Engineer* for April, 1912.

A SYSTEM FOR RECORDING TIME OF CONSTRUCTION FORCES

BY ROBT. G. MCCONNELL.

For a long time there has been felt the want of some accurate means of recording time, particularly in connection with railway signaling installations, whereby some authentic data could be compiled as to the cost of labor necessary for the installation of the miscellaneous types of signal apparatus constituting the various methods of interlocking and block signaling systems on the market.

It is surprising how little thought has been advanced on a subject so important as that of recording the cost of signal installations. This is due largely to the fact that those who are responsible for the operations of the construction organizations are busily engaged with engineering and supervision of the field work, and, consequently, the work of timekeeping is detailed to a man appointed to the position of "timekeeper," who, as quite often happens, has no knowledge of signaling work, and is, of course, laboring under a great disadvantage.

The common and most general form used to-day for recording the time of construction forces, is by means of the commercial time books now on the market, which have proved unsatisfactory in many respects; and, strange to say, the average man who has made use of these commercial forms, has taken for granted that they are perfect for all time, and, consequently, has not advanced anything new.

The time journal is the record of the contract's advancement, and is so important a record that precautionary steps should be taken to safeguard it in every possible manner.

The usual method of recording time is by means of a field timekeeper, or foreman, who travels over the work in process of construction and records the men at work daily. These daily tabulations of the hours expended by the men employed on the job are then transcribed at the close of each day from the field time book in a time journal, which is designed as a permanent authentic record for future reference at the company's headquarters.

It frequently occurs that in a contract for a signaling installation covering territory taking in a number of interlocking plants and also block signal sections, several construction forces are engaged along similar lines of work, and in order to determine the exact cost of each installation under the supervision of the different foremen and crews, it is quite essential that some adequate means of recording the time and comparative cost of each installation be maintained. Toward this end, it is desirable that some authentic daily record be secured on the ground. To meet a requirement of this nature, it is necessary that the scheme of recording the various classes of labor performed daily be so designed that the field timekeeper can operate quickly and without any great amount of writing or annoyance.